



May 8, 2003

DESIGN MEMORANDUM No. 03-05
TECHNICAL ADVISORY

TO: All Design, Operations, District Personnel, and Consultants

FROM: /s/ Anthony L. Uremovich
Anthony L. Uremovich
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Contracts and Construction Division

SUBJECT: Partial 3R Projects

SUPERSEDES: *Indiana Design Manual Chapter Fifty-six*

COMPLEMENTS: *Indiana Design Manual Chapters*
Five, Fourteen, Thirty-one, Forty, and Fifty-two

EFFECTIVE: Immediately

RECURRING PLAN DETAILS

The following recurring plan details complement this memorandum. They should be incorporated into partial 3R contract document sets as required until they are superseded by standard drawings. The supersession will be effective with the March 2004 letting. The drawings are as follows:

- 400-R-448d Termination of Mainline Pavement Treatment
- 400-R-449d Pavement Wedge Limits for Private or Commercial Drive
- 400-R-450d Public Road Approach Paving

Metric- and english-units versions are attached to this memorandum's electronic file.

I. PARTIAL 3R PROJECTS

I-1.0 INTRODUCTION

Many highways cannot meet the values for full Resurfacing, Restoration, and Rehabilitation (3R) criteria. For these reasons, the Department has adopted a Partial 3R concept with different limits for geometric design criteria for pavement rehabilitation projects on existing highways. This is due to constraints in right of way, construction time, pavement conditions, or cost. The criteria for rehabilitation of existing highways are based on sound engineering practices, experience, and assessment of the basic principles of geometric design and how the criteria for other types of construction can be adapted to existing highways within practical limits. The goal of partial 3R is to preserve and maintain the existing highway system.

This chapter presents the Department's criteria and guide to the development of partial 3R projects. The objective of this chapter is to unify and standardize the project development, design criteria, field data collection, and final presentation of plans and related documents used in the development of partial 3R projects. This chapter should not be interpreted as specifications and should not replace sound judgment. The designer should refer to the INDOT *Standard Drawings* or the *Standard Specifications* to resolve questions concerning materials, standard details, workmanship, pay items, pay units, etc.

The designer is referred to *Indiana Design Manual* Chapter Fifty-two, or the AASHTO *Policy for Geometric Design of Highways and Streets* for additional information.

Where a partial 3R project scope of work includes costly items such as bridge reconstruction or replacement or major alignment corrections which have a long service life, the project should be returned to the engineering assessment stage, for consideration as 3R, 4R, or possibly new construction.

I-2.0 ENGINEERING ASSESSMENT

The appropriate district development office, in cooperation with the Program Development Division and the Materials and Tests Division's Pavement Design Section, will determine the need for and propose partial 3R work on a given route. The district will make a recommendation and justification regarding the type of partial 3R project. The recommendation will be reviewed by the Program Development Division's pavement management engineer, safety management engineer, and Pavement Preservation Program Management Group. The Group will use its Pavement Management System to determine the needs of the pavement and to document the condition of the pavement prior to approving the appropriate type of treatment. The Group will then discuss its findings with the district. The Program Development Division and the district are to ultimately concur in whether the partial 3R project should be designed as a preventative maintenance, functional, or structural treatment, or instead, a full 3R project. The safety

management engineer may make recommendations relative to highway safety needs. The Program Development Division then authorizes the project. This information is provided to the district's development section, which then begins the design process.

Right-of-way acquisition should generally not be required for partial 3R work.

The following defines the typical scope of work to be performed for each type of partial 3R project.

I-2.01 Types of Partial 3R Projects

I-2.01(01) Preventative Maintenance Treatment

Preventative maintenance consists of pavement surface treatments used to preserve and extend the service life of the pavement. It should be designed in accordance with Section V-1.04(01) of this memorandum.

I-2.01(02) Functional Treatment

A functional treatment should be used to correct pavement deficiencies such as roughness or poor frictional properties. The intent is to improve the roadway serviceability by correcting distresses caused by traffic and environmental conditions. It should be designed in accordance with Section V-1.04(02) of this memorandum.

I-2.01(03) Structural Treatment

A structural treatment should be used where the existing pavement structure has failed due to a load-related distress. It should be designed in accordance with Section V-1.04(03) of this memorandum.

I-2.02 Analysis of Crash Data

Crash data should be analyzed in accordance with *Indiana Design Manual* Section 55-5.01, except that a formal report is not necessary. Locations with a definite crash pattern should be indicated on the accident data computer printout. Spot-improvements work at such locations should either be incorporated into the project or programmed separately.

I-2.03 Project Classification

Classification of work as partial 3R, full 3R, partial 4R, or full 4R must be determined in accordance with Section 40-6.0.

A partial 3R project is intended to extend the service life of the pavement and, where practical, to enhance highway safety. Geometric design improvements are usually included to correct obvious deficiencies on the existing highway. Right-of-way acquisition is rarely involved. Improvements for a partial 3R project may include any of the following:

1. pavement resurfacing,
2. lane and shoulder widening,
3. adjustments to the roadside clear zone,
4. relocating utility poles,
5. upgrading guardrail and other safety appurtenances to meet current criteria,
6. correcting high-accident locations,
7. drainage improvements, and/or
8. improving superelevation to extent practical.

The only partial 3R treatment permitted on an NHS route is preventative maintenance. All types of partial 3R treatments are permitted on a non-NHS route.

I-3.0 PRELIMINARY DESIGN PROCESS

Preliminary project parameters and criteria are discussed and outlined below.

I-3.01 Review of Earlier Work in the Project Site

The designer should review the existing project files, plans, and resurface contract documents, if applicable, for additional information. Such plans generally contain original stationing, roadbed characteristics, structure information, and original drainage patterns. Previous resurface contract documents may contain valuable supplemental information. See Figure II-A for a blank Request for Traffic Projections form. See Figure II-B for a blank Request for Crash Records form.

I-3.02 Preliminary Project Schedule

The designer should prepare a preliminary schedule for the project with estimated completion dates for the following key activities or mileposts.

005 Project Started

040	Project Scope Complete
060	Start Plan Development
075	Survey Complete
085	Preliminary Field Check
110	Geotechnical Investigation (if required)
115	Final Pavement Design Approval
185	District Plans Complete
205	Plans Signed
215	Utilities Coordination
245	Ready for Letting

I-3.03 Environmental Document

The designer should verify the need for an environmental document and identify the required environmental permits. All projects require some level of environmental documentation. For a partial 3R project, such documentation consists of a Categorical Exclusion. A Categorical Exclusion is described in *Indiana Design Manual* Section 7-1.01(01).

I-3.04 Bridge Structure Considerations

Where bridge structures are encountered within the project limits, the designer should consult with the district bridge engineer concerning needed improvements or needed repairs. A memorandum should be written to the Program Development Division's bridge management engineer with a copy to the Design Division's bridge rehabilitation engineer. The memorandum should provide details about the proposed project, and request their comments and recommendations. The memorandum should address proposed milling, spot pavement replacement, horizontal and vertical clearances if they are factors, weight restrictions, and all other factors which could affect the structures.

I-3.05 Unusual Soil Conditions

If there are indications of peat deposits, rock outcroppings, or other unusual soil conditions, long-term repair of such items should be programmed separately through INSTIP.

I-3.06 Stationing

Stationing should match the existing plans where possible. If the project limits extend beyond the stationing limits of the existing plans, the stationing should be extended to cover the project

limits. Stationing should refer to the Reference Post System (RPS). For known features, see the Physical Features Inventory. Stations should be marked onto the pavement with traffic paint rather than spray paint. Stationing marking options are shown in Figure I-3A.

If new metric stationing must be used, it should have an assumed starting station of 1+000. (If new english stationing must be used, it should have an assumed starting station of 100+00.)

I-3.07 Field Notes

The designer should ascertain that all field data is adequate to design the project. See Figure I-3B, Collection of Field Data, for forms and format. Field notes should be collected in the form of a strip map showing all existing details including, but not limited to, intersecting roads, drives, and railroads, pipe structures, headwalls, curbs, manholes, survey monuments, guardrail, traffic detector loops, stop lines, crosswalk lines, raised pavement markers, areas of grading, patching, milling, utilities in the area, or other specialty items. All items shown in the field notes should have a station and offset reference. Field notes should start at the bottom of the page and proceed upstation. It is not necessary to strip-map sections of the project which are consistent and which no work, other than paving, is specified. For this situation, a note reading “Consistent section from Station ____ to Station ____.” should be shown, thence continuing with the stationing. Cross sections should be collected in a survey level field book, or in an approved electronic format. Cross sections may include sections for pipe replacement, linear grading, drainage, profiles, or other miscellaneous information.

If a field book is used, the front cover of the field book should be labeled as shown in the following example:

FIELD NOTES
DES NO. _____
_____(route)____
FROM ____ km (dir.) of (route) TO ____ km (dir.) of (route)
[FROM ____ mi (dir.) of (route) TO ____ mi (dir.) of (route)]
RP ____+__ TO RP ____+__
_____ DISTRICT

The data collector should collect the field data in a logical manner. Information regarding the content of the field book is shown in *Indiana Design Manual* Chapters Twenty-two and Twenty-three. The procedure for collecting field notes is as follows:

EXISTING ROADWAY – FIELD NOTES

ROUTE_____

PAGE _____

FROM _____ TO _____

North Arrow

--	--

[illegible]

COLLECTION OF FIELD DATA

Figure I-3B

1. Walk the roadway to be sure that everything is logged.
2. By category, count all mailbox approaches, field entrances, commercial drives, etc. Those with unusual sizes or shapes should be located by station and offset, and the dimensions noted in detail.
3. Note locations of underdrains and outlets.
4. Note pavement and shoulder types and width changes by station or dimensions.
5. Note all of the information required relative to the items listed on the Review of Traffic Items.
6. The maintenance section, prior to the field survey, should have furnished a list of structures to be replaced, side ditches to be cleaned, etc. All dimensions, elevations, or other information needed to design the changes in these items should be gathered at this time.
7. If gabions or riprap are required, obtain all of the data necessary to incorporate them into the design.
8. If new or additional guardrail is required, information should be collected for design.
9. If outcroppings are to be removed, gather enough information in the field to be able to calculate the quantity involved.
10. If subgrade failures or slope failures are observed, the Materials and Tests Division's Geotechnical Section should be contacted for further evaluation.

The above is not a full nor a complete list of items necessary to collect field information. Additional field research may be needed to accomplish the design.

Additional survey data may be required. If so, a survey may be performed to gather additional information such as structure inlet and outlet elevations, existing pavement grades, drainage areas, channel cross sections, horizontal or vertical realignment of existing facility, right-of-way needs, etc.

I-3.08 Plan Development

See Section III of this memorandum for these requirements.

I-3.09 Field Checks

See Sections III (03) and III (08) of this memorandum for these requirements.

I-3.10 Pavement Design

See Section V of this memorandum for these requirements.

I-3.11 Revised Project Schedule

The designer should prepare a revised schedule for processing the project through the design phases including additional activities that were not included in the preliminary schedule. This revised schedule should be submitted to the Head Design Engineer and should be updated on a monthly basis or as required. The revised schedule should allow a minimum of 14 weeks prior to the letting date as the time at which the contract documents should be complete and ready for transmittal.

I-4.0 GENERAL DESIGN PARAMETERS

I-4.01 General Standards Requirements

All INDOT *Standard Specifications* and *Standard Drawings* will apply. All deviations from the *Standard Specifications* and *Standard Drawings* will be subject to approval by the Contracts and Construction Division Chief. A deviation from the *Standard Specifications* will require detail drawings and special provisions subject to the approval of the Contracts and Construction Division Chief. The designer should see *Indiana Design Manual* Section 19-2.0 for instructions on writing special provisions.

I-4.02 References and Research Sources

Many references and research sources are available to use as design references for supplemental information. Typical sources may include the following:

1. INDOT *Standard Drawings*
2. INDOT *Standard Specifications* and current Supplemental Specifications
3. AASHTO's *A Policy on Geometric Design of Highways and Streets*
4. *Indiana Design Manual* Chapter Fifty-two, Pavement and Underdrain Design Elements

5. *Indiana Design Manual* Chapter Fifty-four, Geometric Design of Existing Freeways (4R)
6. *Indiana Design Manual* Chapter Fifty-five, Geometric Design of Existing Non-Freeways (3R)
7. Road Logs and Bridge Logs
8. Pavement Management System
9. No-Passing Zone Logs
10. Other miscellaneous sources including previous plans, pavement histories, etc.

I-4.03 Desirable and Minimum Pavement Width Requirements

The values shown in Figures I-4A, I-4B, I-4C, and I-4D should be used for the design of pavement, travel-lane, shoulder, and curb-offset widths. If existing widths are greater than the values shown in the figures, the existing widths should be used.

The minimum width of pavement widening, where used, should be 0.6 m (2 ft) for constructability. The maximum width of pavement widening should not exceed that shown in *Indiana Design Manual* Section 52-9.02(09). If widening varies from side to side of the existing pavement, a strip map or a typical cross section showing widening by stations should be provided. If cut or fill slopes are required, cross sections should be provided.

I-4.04 Mainline Pavement Considerations

Considerations to be made regarding specific mainline pavement and approaches items for each type of partial 3R treatment are shown in Figure I-4E. Some of these items are further detailed below.

Work of a larger magnitude than that shown in Figure I-4E for a given treatment may be done. Such work should be considered as a spot improvement, designed to the appropriate standards.

I-4.04(01) Auxiliary Lanes

Incorporating or upgrading turn lanes, parking lanes, passing blisters, or other auxiliary lanes to reduce the disruption of the flow of traffic should only be considered for a structural treatment. A geotechnical evaluation may be required. A partial 3R project involves few agreements and should require no additional right of way. The guidelines in *Indiana Design Manual* Chapter Forty-six may not be attainable due to budgetary constraints and right of way acquisition. Auxiliary lanes which cannot be considered in the project may be separately programmed as a spot improvement or into a future full 3R or 4R project. See *Indiana Design Manual* Chapter Fifty-four or Fifty-five for appropriate requirements.

METRIC	Total Paved Width ^{1,2,3}	Travel Lane Width ²	Paved Shld. Width	Sealed Agg. Shld. Width
AADT ≥ 5,000	D = 8.4 m M = 7.8 m	D = 3.6 m M = 3.6 m	D = 1.8 m M = 0.3 m	N / A
3,000 < AADT < 5,000	D = 8.4 m M = 7.8 m	D = 3.6 m M = 3.6 m	D = 1.2 m M = 0.3 m	D = 0.9 m M = 0.6 m
400 ≤ AADT < 3,000	D = 8.4 m M = 7.2 m	D = 3.6 m M = 3.3 m	D = 0.6 m M = 0.3 m	D = 0.9 m M = 0.6 m
AADT < 400	D = 7.8 m M = 6.6 m	D = 3.3 m M = 3.0 m	D = 0.6 m M = 0.3 m	D = 0.6 m M = 0.3 m

ENGLISH	Total Paved Width ^{1,2,3}	Travel Lane Width ²	Paved Shld. Width	Sealed Agg. Shld. Width
AADT ≥ 5,000	D = 28 ft M = 26 ft	D = 12 ft M = 12 ft	D = 6 ft M = 1 ft	N / A
3,000 < AADT < 5,000	D = 28 ft M = 26 ft	D = 12 ft M = 12 ft	D = 4 ft M = 1 ft	D = 3 ft M = 2 ft
400 ≤ AADT < 3,000	D = 28 ft M = 24 ft	D = 12 ft M = 11 ft	D = 2 ft M = 1 ft	D = 3 ft M = 2 ft
AADT < 400	D = 26 ft M = 22 ft	D = 11 ft M = 10 ft	D = 2 ft M = 1 ft	D = 2 ft M = 1 ft

D = Desirable, M = Minimum.

¹ Includes widths of Travel Lanes and Paved Shoulders only.

² Should be widened on curves where possible as described in *Indiana Design Manual* Section 43-2.06.

³ For a road with a TWLTL, these widths will be increased by the applicable width of a TWLTL.

* All pavement or shoulder widening should be a minimum of 0.6 m (2 ft) for constructability.

PAVEMENT WIDTHS FOR RURAL 2-LANE ROADS WITH SHOULDERS

Figure I-4A

METRIC	4-Lane Total Paved Width ^{1,2}	6-Lane Total Paved Width ¹	Travel Lane Width	Outside Paved Shoulder Width	Median Paved Shoulder Width
Divided	D = 10.8 m M = 9.3 m	D = 14.4 m M = 12.2 m	D = 3.6 m M = 3.3 m	D = 2.4 m M = 1.2 m	D = 1.2 m M = 0.9 m
Undivided	D = 9.6m M = 7.8 m	D = 13.2 m M = 11.1 m	D = 3.6 m M = 3.3 m	D = 2.4 m M = 1.2 m	N / A

ENGLISH	4-Lane Total Paved Width ^{1,2}	6-Lane Total Paved Width ¹	Travel Lane Width	Outside Paved Shoulder Width	Median Paved Shoulder Width
Divided	D = 36 ft M = 29 ft	D = 48 ft M = 40 ft	D = 12 ft M = 11 ft	D = 8 ft M = 4 ft	D = 4 ft M = 3 ft
Undivided	D = 32 ft M = 26 ft	D = 44 ft M = 37 ft	D = 12 ft M = 11 ft	D = 8 ft M = 4 ft	N / A

D =Desirable, M = Minimum.

¹ Includes widths of Travel Lanes and Paved Shoulders for one direction of travel on a divided road.

² For a road with a TWLTL, these widths will be increased by the applicable width of a TWLTL.

* All pavement or shoulder widening should be a minimum of 0.6 m (2 ft) for constructability.

PAVEMENT WIDTHS FOR RURAL MULTI-LANE ROADS WITH SHOULDERS

Figure I-4B

METRIC	Total Width 1,2	Travel Lane Width	TWLTL	Curb Offset Distance
Suburban ³	D = 7.8 m M = 6.0 m	D = 3.6 m M = 3.0 m	D = 3.6 m M = 3.6 m	D = 0.3 m M = 0.0 m
Intermediate ³	D = 7.8 m M = 6.6 m	D = 3.6 m M = 3.0 m	D = 3.6 m M = 3.3 m	D = 0.3 m M = 0.0 m
Built-Up ³	D = 7.8 m M = 6.0 m	D = 3.6 m M = 3.0 m	D = 3.6 m M = 3.0 m	D = 0.3 m M = 0.0 m

ENGLISH	Total Width 1,2	Travel Lane Width	TWLTL	Curb Offset Distance
Suburban ³	D = 26 ft M = 20 ft	D = 12 ft M = 10 ft	D = 12 ft M = 12 ft	D = 1 ft M = 0 ft
Intermediate ³	D = 26 ft M = 22 ft	D = 12 ft M = 10 ft	D = 12 ft M = 11 ft	D = 1 ft M = 0 ft
Built-Up ³	D = 26 ft M = 20 ft	D = 12 ft M = 10 ft	D = 12 ft M = 10 ft	D = 1 ft M = 0 ft

D =Desirable, M = Minimum. TWLTL = two way left turn lane.

¹ Total width face to face of curb.

² For a road with a TWLTL, these widths will be increased by the applicable width of a TWLTL.

³ See *Indiana Design Manual* Section 40-1.02 for definitions.

* All pavement or shoulder widening should be a minimum of 0.6 m (2 ft) for constructability.

PAVEMENT WIDTHS FOR URBAN 2-LANE ROADS WITH CURBS

Figure I-4C

METRIC	4-Lane Total Width 1,2	6-Lane Total Width ¹	Travel Lane Width	TWLTL	Curb Offset Distance
Suburban ³	D = 8.4 m M = 7.2 m	D = 12.0 m M = 10.5 m	D = 3.6 m M = 3.3 m	D = 3.6 m M = 3.3 m	D = 0.6 m M = 0.3 m
Intermediate ³	D = 8.4 m M = 7.2 m	D = 12.0 m M = 10.5 m	D = 3.6 m M = 3.3 m	D = 3.6 m M = 3.3 m	D = 0.6 m M = 0.3 m
Built-Up ³	D = 8.4 m M = 6.6 m	D = 12.0 m M = 9.6 m	D = 3.6 m M = 3.0 m	D = 3.6 m M = 3.3 m	D = 0.6 m M = 0.3 m

ENGLISH	4-Lane Total Width 1,2	6-Lane Total Width ¹	Travel Lane Width	TWLTL	Curb Offset Distance
Suburban ³	D = 28 ft M = 24 ft	D = 40 ft M = 35 ft	D = 12 ft M = 11 ft	D = 12 ft M = 11 ft	D = 2 ft M = 1 ft
Intermediate ³	D = 28 ft M = 24 ft	D = 40 ft M = 35 ft	D = 12 ft M = 11 ft	D = 12 ft M = 11 ft	D = 2 ft M = 1 ft
Built-Up ³	D = 28 ft M = 22 ft	D = 40 ft M = 32 ft	D = 12 ft M = 10 ft	D = 12 ft M = 11 ft	D = 2 ft M = 1 ft

D =Desirable, M = Minimum. TWLTL = two way left turn lane.

¹ Total width face to face of curb for one direction of a divided road.

² For a road with a TWLTL, these widths will be increased by the applicable desirable or minimum width of a travel lane.

³ See *Indiana Design Manual* Section 40-1.02 for definitions.

* All pavement or shoulder widening should be a minimum of 0.6 m (2 ft) for constructability.

PAVEMENT WIDTHS FOR URBAN MULTI-LANE ROADS WITH CURBS

Figure I-4D

I-4.04(02) Castings

Castings need not be reset if the overlay depth is equal to the milling depth. However, if the finished grade is different from the original grade, the adjustment of the castings should be incorporated into the work.

In an unincorporated area, Department storm sewer and sanitary sewer castings should be adjusted to grade as required. In an incorporated area, the local utilities should be required to adjust castings as required. See *Indiana Design Manual* Chapter Thirty-six for more information.

In areas to be surface milled, all utility castings, as well as storm-sewer and sanitary-sewer castings, should be located and identified.

I-4.04(03) Cross Slopes

1. Travel Lanes. Pavement cross slopes on tangent sections should be reviewed for all types of partial 3R treatments. Improving pavement cross slope, where required, may be completed through staged construction, e.g., combining surface milling with pavement core investigation with a variable depth cross-section of HMA Intermediate course in accordance with the INDOT *Standard Specifications* prior to placing a uniform-depth HMA Surface course.

A preventative maintenance treatment is exempt from crown correction only if the existing rural pavement cross slope is 2%, or if the existing urban pavement cross slope is 1.5 to 3%. If the slope is outside this range, a combination of surface milling and a uniform-depth HMA Surface course should be used.

2. Shoulders. Paved shoulder slopes should match the mainline cross slope or the existing shoulder slope, or should desirably be 4%. Aggregate and earth shoulder slopes should be 4% to 8%. In a horizontal curve, shoulder slope should be determined in accordance with *Indiana Design Manual* Section 43-3.0.

I-4.04(04) Curbs

In areas where the curb height is not adequate for drainage, curb replacement should be considered. The pavement in these areas should be evaluated for possible future replacement.

Pavement Treatment	Prvnt. Maint.	Func- tional	Struc- tural
<i>Approaches,</i>			
Drives, Relocate or Redesign	C	C	B
Drives, wedge 1 m adjacent to mainl. pvmt.	A	A	A
Mailbox, Improve to Standard or Incorporate	C	C	B
Mailbox, Overlay Existing	A	A	A
Public Road, Treat to Mainline R/W Line	A	A	A
<i>Auxiliary Lanes,</i>			
Improve to Current Standards or Incorporate			
Channelization Lanes	C	C	B
Climbing Lanes	C	C	C
Parking Lanes	C	C	B
Passing Blisters	C	C	B
Turn Lanes	C	C	B
<i>Castings,</i>			
Adjust to Grade	C	B	A
<i>Cross-Slope Correction,</i>			
Convert Tilt Section to Crown Section	C	B	A
Correct to 2%	B	A	A
<i>Curbs,</i>			
Repair	B	B	B
Replace	C	B	B
<i>Drainage Structures,</i>			
Repair, Clean, or Adjust	B	B	B
<i>Intersections,</i>			
Improve Sight Distance and Radii	C	C	B
<i>Lanes,</i>			
Widen to Minimum or Desirable Standards ¹	C	C	B
<i>Median,</i>			
Convert to Two-Way Left-Turn Lane	C	C	B
<i>Monuments,</i>			
Perpetuate	A	A	A

Key to letters A, B, and C is shown at the end of the table.

PARTIAL 3R WORK
Mainline Pavement and Approaches Considerations

Figure I-4E

Pavement Treatment	Prvnt. Maint.	Func- tional	Struc- tural
<i>Patching</i>	B	A	A
<i>Shoulders, Widen to Minimum or Desirable Standards ²</i>	C	B	B
<i>Sight Distance Improvements,</i> Horizontal	C	B	B
Vertical	C	B	B
<i>Subsurface Drainage,</i> Underdrains, Clean or Repair	B	B	B
Underdrains, Place or Replace	C	C	B
<i>Superelevation Rate, Improve to Current Standards ³</i>	C	B	A
<i>Underpass Vertical Clearance, Maintain Current Distance</i>	A	A	A
<i>Urban Surface Drainage, Mill as Required to Maintain or Correct</i>	B	A	A

Key to letters in table:

A = Item should be included as part of the project.

B = Item may be included.

C = Item should not be included. If it is considered, it should be programmed separately as a spot improvement.

Notes:

¹ Minimum and desirable standards are shown in Figures I-4A, I-4B, I-4C, and I-4D.

² Minimum and desirable standards are shown in Figures I-4A, I-4B, I-4C, and I-4D. Paved shoulders are desirable they can be placed without affecting drainage or side ditches.

³ Current standards are shown in *Indiana Design Manual* Section 43-3.0

PARTIAL 3R WORK Mainline Pavement and Approaches Considerations

Figure I-4E (Continued)

I-4.04(05) Monuments

All existing Department monuments should be perpetuated. The designer is responsible for contacting the county surveyor for a list of monuments to be reset, witnessed, and monumented. All affected monuments are to be shown on the plans, or the required information is to be provided prior to construction.

I-4.04(06) Sight Distance Improvements

Existing geometrics should be maintained if no adverse accident history exists. See *Indiana Design Manual* Chapter Fifty-five for desirable geometric criteria.

I-4.04(07) Subsurface Drainage

Subsurface drainage should always be considered and perpetuated in areas where it currently exists. For a structural treatment, addition of subsurface drainage should be considered. See *Indiana Design Manual* Section 52-10.0 for subsurface drainage design requirements.

I-4.04(08) Superelevations and Curves

For a functional or structural treatment, evaluations of existing curves and superelevations should be performed. For a structural treatment, the pavement slope should be in accordance with the superelevation requirements shown in *Indiana Design Manual* Section 43-3.0 where possible.

I-4.04(09) Surface Milling

Milling of HMA pavement may be used to adjust roadway cross section, develop or maintain curb exposure, remove wheel ruts, tie the new pavement into existing pavement, improve drainage, or remove undesirable areas or layers of pavement. Surface milling of an entire project will be decided on a case-by-case basis and will be subject to approval by the district's head design engineer or the Materials and Tests Division's pavement design engineer. Existing layers of HMA Surface Sand on or near the surface should be removed. Cores should be taken and analyzed by the district testing section to ensure that the proposed milling can be performed. Where milling is proposed near a signalized intersection, the designer should coordinate with the district traffic section to either avoid or replace existing signal loops. Details for milling at the project termini are shown on Recurring Plan Detail E / 400-R-448d.

Where surface milling is specified, the designer should contact either the district operations field engineer or the subdistrict manager to determine if the subdistrict wants the milled material. The operations field engineer or subdistrict manager will specify the quantity of milled material to be delivered to a predetermined location. The designer should include arrangements regarding milled material in the special provisions.

I-4.04(10) Urban Surface Drainage

Improvements to an urban surface drainage system to correct water ponding that may be causing pavement stability problems may be included in a partial 3R project. Where surface milling is required to achieve drainage of low spots where water collects, or to remove existing asphalt, pavement cores should be obtained in the area to assess the pavement structure.

I-4.05 Approaches

It has been the practice of the Department to maintain the surfaces of the approaches to its routes. The limits and type of treatment vary with the type of approach. The various treatments and limits used to maintain these approaches in conjunction with partial 3R work are provided in this section.

All approaches should be in accordance with the INDOT *Standard Specifications* and *Standard Drawings*. Approach data tables may be provided for supplemental information. See *Indiana Design Manual* Chapters Forty-six and Fifty-two for approach design criteria where approach improvements are to be made.

I-4.05(01) Public Road Approach

This type of approach should be overlaid to the apparent right-of-way line, unless the approach is another Department-maintained route which has recently been, or is scheduled to be treated within two years of completion of the partial 3R project. Every effort should be made to construct shoulders on each approach where shoulders exist or are being constructed on the mainline. The approach geometry should comply with the INDOT *Standard Drawings* as nearly as possible, especially where approaching a mainline pavement with AADT 3,000. An existing paved public road approach should be overlaid to match the existing mainline's edge line elevation, and tapered to match the profile on the approach at the apparent right-of-way line through the use of a milled notch at the terminus. See Recurring Plan Detail E / 400-R-450d for details.

I-4.05(02) Drives

1. Asphalt. The partial 3R treatment of an asphalt drive consists of a 1.0-m (3-ft) wide wedge of HMA for Approaches placed adjacent to the mainline or shoulder pavement as shown on Recurring Plan Detail E / 400-R-449d. This 1.0-m (3-ft) width, depending on the depth of the mainline overlay, may not be practical and may need to be extended to prevent a hump or adverse rollover (grade break) that is unacceptable.
2. Concrete. For a concrete drive, a wedge of HMA for Approaches should be placed over the concrete terminating in a milled notch as shown on Recurring Plan Detail E / 400-R-450d. The approach design length is based on the overlay depth on the mainline and an acceptable resultant grade on the approach.
3. Aggregate. For an aggregate drive adjacent to a nonpaved shoulder, a 1.0-m (3-ft) widening with HMA for Approaches should be placed adjacent to the outer edge of the mainline or shoulder pavement. After placement of the widening, if a grade differential exists, it should be wedged out with compacted aggregate. Rollover criteria should be considered.
4. Field Entrance. This type of drive is typically earth. Fill is placed as required and compacted to the edge-of-shoulder or -pavement elevation.

I-4.05(03) Mailbox Approach

An existing mailbox approach may be substandard and most often cannot be corrected within the existing right of way. In a preventative maintenance or functional treatment, this type of approach should be overlaid to match the mainline elevation by use of the same paving material specified for the shoulders. In a structural treatment, a substandard approach deemed to be a hazard that can be improved should be improved to the geometrics shown in the INDOT *Standard Drawings*.

I-4.06 Roadside Considerations

The designer must keep focused on the objectives of the scope of work that has been established for an individual partial 3R project in order to apply the appropriate roadside safety improvements.

Roadside safety improvements should be considered as described in Figure I-4F. Some of these items are further detailed below.

I-4.06(01) Guardrail and End Treatments

Where required, a Guardrail Summary Table should be prepared for areas with guardrail placement or modifications.

The field notes and design calculations should be submitted with the project file. Guardrail requiring modifications not shown in the INDOT *Standard Drawings* should be detailed on the plans.

Guardrail end treatments type I may be in place but are now inappropriate due to higher design-year average annual daily traffic counts than they are warranted for. Such treatments should be considered for replacement with type OS or MS treatments as appropriate for a functional or structural treatment.

I-4.06(02) Linear Grading

Linear grading may be called for as a pay item only where earth is wedged at the outside edge of the shoulder where the profile grade has been raised due to overlaying or widening the pavement, or earth is wedged behind guardrail to obtain the required earth backup for the posts.

I-4.06(03) Mailbox Assemblies

Existing mailbox assemblies may remain in place during the performance of most partial 3R work. If a mailbox assembly is to be moved to accommodate a functional or structural treatment, a standard assembly as shown in the INDOT *Standard Drawings* should be considered for the replacement. See *Indiana Design Manual* Section 49-3.01(02) for design criteria.

I-4.06(04) Side Ditches

For a structural treatment, efforts should be made to re-establish drainage patterns and grades similar to the original construction. Where right of way is sufficient, efforts should be made to establish flow lines 450 mm (1.5 ft) below the pavement centerline grade as a minimum, or 300 mm (1 ft) below the subsurface drain outlets in accordance with *Indiana Design Manual* Section 52-10.0.

I-4.06(05) Side Slopes

For a preventative maintenance or a functional treatment, side slopes of steeper than 3:1 are acceptable.

Pavement Treatment	Prvnt. Maint.	Func- tional	Struc- tural
<i>Culverts,</i>			
Extend	B	B	A
Modify	B	B	A
Place New	C	C	C
Repair and Clean	B	B	A
Replace	B	B	A
Headwalls, Remove	C	B	A
<i>Eroded Areas,</i> Grade and Seed or Sod	B	B	A
<i>Guardrail End Treatments,</i>			
Repair Damaged	A	A	A
Replace product not on appvd. list with appvd. prod.	B	B	B
Replace type I with type MS or OS as req'd.	B	A	A
<i>Highway Signs,</i> Replace	C	C	B
<i>Impact Attenuators,</i>			
Repair Damaged	A	A	A
Replace product not on appvd. list with appvd. prod.	B	B	B
<i>Linear Grading</i>	C	C	B
<i>Mailboxes,</i> Replace with Current Standard	C	B	B
<i>Obstruction-Free Zone Clearance,</i> Remove Fixed Objects > 100 mm (4") Above Grd. ³	C	B	B
<i>Pavement Markings and Delineation,</i>			
Pavement Markings, Place	A	A	A
Roadside Delineators, Place or Replace	B	B	B
Raised Pavement Markers, Place	C	B	B
Raised Pavement Markers, Replace	B	B	B
<i>Side Ditches,</i> Reshape or Riprap	B	B	B

Key to work incidental to paving is shown at the end of the table.

PARTIAL 3R WORK
Roadside, Culverts, and Traffic Considerations

Figure I-4F

Pavement Treatment	Prvnt. Maint.	Func- tional	Struc- tural
<i>Side Slopes,</i> Flatten to Traversable Levels	C	C	B
<i>Sidewalks,</i> Repair or Replace	C	C	C
<i>Sidewalk Curb Ramps at Intersections,</i> Repair existing Upgrade existing to ADA requirements Place in exist. sdwks. per ADA requirements	B B C	A B A	A B A
<i>Traffic Barriers,</i> Bridge Railing, Upgrade to Current Standards Guardrail, Repair or Replace Damaged Guardrail, Replace Obsolete ¹ or Weathered Guardrail, Place or Lengthen to Current Standards ² Guardrail to Bridge Railing, Connect Guardrail Transition, Upgrade to Current Standards	C A C C C C	C A B B A C	C A B B A C
<i>Traffic Signals,</i> Add or Upgrade Detector Loops or Handholes, Perpetuate	C A	C A	B A

Key to work incidental to paving:

A = Item should be included as part of the project.

B = Item may be included.

C = Item should not be included. If it is considered, it should be programmed separately as a spot improvement.

Notes:

¹ Obsolete guardrail should be treated as shown in *Indiana Design Manual* Section 49-4.02.

² Treat as described in *Indiana Design Manual* Section 55-5.04.

³ For example, trees, bushes, posts, rocks, private signs, etc. See *Indiana Design Manual* Section 55-5.02 for obstruction-free-zone information.

PARTIAL 3R WORK Roadside, Culverts, and Traffic Considerations

Figure I-4F (Continued)

All roadside slopes which appear to be steeper than 3:1 in a structural treatment will require a survey preparation of shoulder cross-section to determine the slope. Locations which appear to be particularly hazardous should be analyzed to determine if an adverse accident history exists, if it is cost effective to provide guardrail, or if a slope correction to a traversable level can be made. Possible guardrail locations will be identified at the field checks. See *Indiana Design Manual* Sections 45-3.01 and 45-3.02 for guidance in determining side slopes. Where significant widening is proposed on the side of an existing embankment, preliminary plans with cross sections should be sent to the Materials and Tests Division's Geotechnical Section for evaluation.

I-4.06(06) Sidewalks

This work is not routinely incorporated into a partial 3R project. However, where it becomes necessary to work in these areas, curb ramps should be treated as shown in Figure I-4E.

I-4.07 Culverts and Drainage Structures Considerations

Culvert modification or replacement requirements for structural treatment work are described in Section IV of this memorandum.

I-4.08 Traffic-Related Work

Traffic-related safety improvements should be considered as described in Figure 56-4F. Some of these items are further detailed below.

I-4.08(01) Highway Signs

Existing regulatory and warning signs anticipated to be impacted by structural-treatment construction operations should be reset or replaced as required in accordance with the INDOT *Standard Specifications* and *Standard Drawings*. See *Indiana Design Manual* Chapter Seventy-five for guidelines regarding highway signs.

A summary sheet or details should be included in the plans to list or detail the locations for new and replacement sign types and required sign posts sizes and quantities.

I-4.08(02) Pavement Markings and Delineation

1. Markings. All permanent pavement markings, including transverse markings, should be replaced in kind. The district traffic section should review the locations and quantities for such markings. The designer should contact the district traffic section to coordinate the desired pavement marking plan. New locations for markings should not be included in the project unless approved by the district traffic engineer. The designer should consider the use of pavement markings as described in *Indiana Design Manual* Chapter Seventy-six.
2. Snowplowable Raised Pavement Markers (RPMs). The designer should contact the district traffic section to confirm the existence of RPMs within the project limits and for special layout patterns that deviate from the INDOT *Standard Drawings*. See *Indiana Design Manual* Section 76-3.02(05) for design criteria, and the INDOT *Standard Drawings* for basic layouts. If no existing RPMs are present, placement of new ones should be considered for a functional or structural treatment in accordance with Department policy.

All existing RPMs should be reviewed for replacement. Where RPMs exist, the designer has the following options for replacing removed RPMs.

- a. Option 1. Install refurbished castings and new prismatic reflectors.
- b. Option 2. Install new castings and new prismatic reflectors.
- c. Option 3. Replacements will be programmed by the district into the INSTIP annual replacement contract.

Option 1 is the most desirable and Option 3 is the most economical. A detailed plan sheet should be provided for layouts that differ from those shown on the INDOT *Standard Drawings*. A sheet may be included in the plans to list the color combinations and quantities of RPMs required for the project.

I-4.08(03) Traffic Signals

Detector loop locations should be identified and should be shown on the plans. All detector housings affected by the overlay operation should be adjusted to grade. Adjustments to existing signal equipment such as signal head reorientation, if required, may be incorporated into the work. A summary sheet or details should be included in the plans to list or detail the locations where loops, detector housings, or handholes are to be replaced or adjusted.

Traffic signals should otherwise only be considered for upgrading or placement in a structural-treatment project.

I-4.09 Design Exception Criteria

I-4.09(01) Level One Criteria Subject to Design Exception

If a work item is shown in Figure I-4E or Figure I-4F as A for a given type of treatment, a Level One or Level Two design exception request is required. A Level One exception is subject to approval of the Design Division Chief. Such work items are listed below.

1. Functional Treatment, A.
 - a. Cross-slope correction to 2%
 - b. Sidewalk curb ramps, repair existing
 - c. Sidewalk curb ramps, place in existing sidewalks per ADA requirements
2. Structural Treatment, A.
 - a. Cross-slope, convert tilt section to crown section
 - b. Cross-slope correction to 2%
 - c. Sidewalk curb ramps, repair existing
 - d. Sidewalk curb ramps, place in existing sidewalks per ADA requirements
 - e. Superelevation rate, improve to standard

I-4.09(02) Level One Criteria Not Subject to Design Exception

Some work items shown in Figure I-4E or Figure I-4F as B or C for a given type of treatment are Level One criteria, but a design exception request is not required. Such B work items are listed below.

1. Preventative Maintenance Treatment, B.
 - a. Cross-slope correction to 2%
 - b. Sidewalk curb ramps, repair existing
 - c. Sidewalk curb ramps, upgrade existing to ADA requirements
2. Functional Treatment, B.
 - a. Cross-slope, convert tilt section to crown section
 - b. Shoulder width
 - c. Sidewalk curb ramps, upgrade existing to ADA requirements
 - d. Superelevation rate, improve to standard
3. Structural Treatment, B.
 - a. Lane width
 - b. Shoulder width

- c. Sidewalk curb ramps, upgrade existing to ADA requirements

The C work items are listed below.

- 4. Preventative Maintenance Treatment, C.
 - a. Bridge railing, upgrade to current standards
 - b. Cross-slope, convert tilt section to crown section
 - c. Lane width
 - d. Shoulder width
 - e. Sidewalk curb ramps, place in existing sidewalks per ADA requirements
 - f. Superelevation rate, improve to standard
- 5. Functional Treatment, C.
 - a. Bridge railing, upgrade to current standards
 - b. Lane width
- 6. Structural Treatment, B.
 - a. Bridge railing, upgrade to current standards

I-4.10 Maintenance of Traffic

A partial 3R project should be able to be completed without a road closure. If a road closure is necessary, the designer should follow the procedure described in *Indiana Design Manual* Sections 82-2.0 and 82-7.02.

The designer should make certain that there is sufficient roadway and shoulder width to safely accommodate both the contractor's equipment and the flow of traffic. If roadway shoulders are to be utilized to carry traffic during construction, they must be capable of withstanding the expected traffic loads and volumes. A traffic control plan should be developed as described in *Indiana Design Manual* Section 82-2.0. The designer should consider the use of temporary traffic control devices as described in *Indiana Design Manual* Chapter Eighty-three.

II. INFORMATION GATHERING

1. Traffic Data. Official traffic counts with projections are provided by the Program Development Division's Traffic Statistics Unit. Requests for traffic data should be transmitted to the Unit's supervisor on the Request for Traffic Projections standard form. A blank copy is shown as Figure II-A. All traffic data must be routed through the Environment, Planning and Engineering Division's Engineering Assessment Section.
2. Crash Data. Historical crash (accident) data are provided by the Program Development Division's Crash Analysis Unit. A Request for Crash Records form should be submitted to the Unit's crash analysis supervisor. A blank copy is shown as Figure II-B. Turnaround time is typically less than one week. In some circumstances, the designer may contact local police agencies for supplemental information.
3. Telemetry and Weigh-In-Motion Stations, and Traffic-Actuated Signals. The designer should check for telemetry stations and weigh-in-motion stations within the project limits. If these are present, the designer should consult with the Program Development Division's Traffic Statistics Unit for further information, and work to incorporate treatment of them into the design. If traffic-actuated signals are present, the designer should consult the district traffic engineer for further information, and work to incorporate treatment of them into the design.
4. Strategic Highway Research Projects (SHRP). The designer should check with the Research Division's Pavement, Materials, and Accelerated Testing Section to determine if SHRP sections, Long-Term Pavement Performance (LTPP), INDOT research, or similar test projects are within the project limits. Where these exist, approval must be obtained from the Program Development Division to proceed with the project.
5. Scheduling Production Management System (SPMS), and INSTIP. The designer should check the SPMS or INSTIP files regarding local public agency improvement requests such as intersection improvements, roadside safety enhancements, or other improvements within the project limits. Such SPMS or INSTIP improvements could be considered for incorporation into the project work if approved.
6. Maintenance and Traffic Programs. The designer should check the District Maintenance and Traffic Contract Programs for work which may be incorporated into the project scope.

INDIANA DEPARTMENT OF TRANSPORTATION

INDIANAPOLIS, INDIANA 46204

INTERDEPARTMENT COMMUNICATION

_____, 20____

REQUEST FOR TRAFFIC PROJECTIONS

MEMORANDUM

TO:

Traffic Statistics Unit Supervisor
Program Development Division

FROM:

(title)
(Division) (District)

PROJECT NO. _____

ROUTE NO. _____

_____ km (mi) _____ of _____ to _____ km (mi) _____ of _____
(dir.) (route) (dir.) (route)

COUNTY _____

For additional information contact _____; Phone: _____

Type of work planned: _____

Year for Traffic Projections: _____

State below IN DETAIL, ALL DATA REQUIRED.

Please include any additional information that will prove helpful in fulfilling your request (i.e., Project Location Map, aerial photos, etc.), and indicate if you want this material returned.

BLANK REQUEST FOR TRAFFIC PROJECTIONS FORM

Figure II-A

INDIANA DEPARTMENT OF TRANSPORTATION

INDIANAPOLIS, INDIANA 46204
INTERDEPARTMENT COMMUNICATION

_____, 20__

REQUEST FOR CRASH RECORDS

MEMORANDUM

TO:

Crash Analysis Unit Supervisor
Program Development Division

THRU:

(title)
(Division) (District)

FROM:

(title)
(Division) (District)

PROJECT NO. _____

ROUTE NO. _____

COUNTY _____

CITY OR TOWN _____

Please provide us crash statistics for the following location.

[If at Intersection] Intersection with _____.

[If Not at Intersection] From _____ to _____.

BLANK REQUEST FOR CRASH RECORDS FORM

Figure II-B

III. PLAN DEVELOPMENT

III (01) Preliminary Plans

1. Title Sheet. The title sheet is the first page and should contain the following information:
 - a. Contract and description code numbers
 - b. Traffic data
 - c. Design data
 - (1) Design speed
 - (2) Project design criteria: Partial 3R (non-freeway)
 - (3) Functional classification
 - (4) Rural or Urban
 - (5) Terrain
 - (6) Access control
 - d. Project description
 - (1) Route number
 - (2) County names and congressional township, range, and section
 - (3) Limits described from Department-maintained route intersections and by Reference Post system
 - (4) Length (gross and net)
 - e. Location map
 - (1) Civil boundaries
 - (2) County, township lines, corporate limits
 - (3) Nearby Department-maintained routes and major local roads
 - (4) North arrow
 - (5) Project limits, with stations and highlighted graphics
 - f. Paving exceptions, with stations
 - g. Equations
 - h. Current standards specifications effective year
 - i. Certification block
 - j. State location map
2. Construction Plans Index. The Construction Plans Index is a tabulation and description of the numbered design drawings to be included in the plans document.

3. Strip Map. The strip map is usually a line drawing showing the following:
 - a. Route number
 - b. Beginning and ending stations and reference posts and station equations.
Consistent units should be used throughout the plans.
 - c. Stations and reference posts for intersecting streets, county roads, city or town limits, and intersecting county lines and railroad crossings, bridges, and paving exceptions.
 - d. North arrow
 - e. Location of all recommended construction signs
 - f. Existing utility lines within construction limits.
 - g. Civil townships
4. Typical Cross Sections. The typical cross sections are composed of four basic parts as follows:
 - a. Illustration.
 - (1) Existing conditions and dimensions (i.e., pavement width, material type, thickness cross-slope, curb, shoulder, ditches, etc.).
 - (2) Proposed construction and dimensions (i.e., HMA courses with binder grading, overlay cross-slope, widening, curb shoulders, ditches, etc.).
 - b. Legend showing labels and corresponding items. The descriptions shown in the pay item names should be used when applicable.
 - c. Title block.
 - (1) Route number
 - (2) Limits of section and exceptions
 - d. Supplemental information block (i.e., curve data for superelevation).
5. Typical Approach Details. The INDOT *Standard Drawings* should be used. Existing field conditions not in accordance with the details shown on the *Standard Drawings* will require details to be shown on the plans.
6. Miscellaneous Details. These include all other details not covered by the strip map, typical section or INDOT *Standard Drawings*.

7. Special Provisions. The designer should follow the guidelines for preparing special provisions described in *Indiana Design Manual* Section 19-2.0. The designer should not specify the use of proprietary or experimental products or construction methods.

III (02) Assessing Preliminary Pavement Design

Once the project has been assessed to be a partial 3R project, the designer should determine an approximate pavement thickness for developing preliminary typical cross sections.

III (03) Preliminary Field Check

The preliminary field check should occur at some point before development of preliminary plans. The preliminary field check should be scheduled with the district sections involved with plan development. The arrangements for scheduling the preliminary field check should be made while plan development is still proceeding, if possible. Copies of preliminary plan documentation should be made available for review prior to the preliminary field check.

Persons who typically should attend the preliminary field check are as follows:

1. District Personnel.
 - a. Head design engineer
 - b. Construction area engineer
 - c. Operations support field engineer
 - d. Subdistrict manager and/or unit foreman
 - e. Designer
 - f. Traffic engineer
 - g. Utilities/railroads engineer
2. Other Personnel.
 - a. Local government agencies if applicable
 - b. Local utilities if applicable
 - c. INDOT pavement design engineer, if AADT ≥ 5000 or ≥ 500 trucks

III (04) Right of Way

Right-of-way acquisition is not normally required for a partial 3R project. If it is required, the designer should return to the engineering assessment phase to consider the project as full 3R, 4R, or possibly new construction.

III (05) Public Hearing

Public involvement is not normally required for a partial 3R project. If it is, the designer should see *Indiana Design Manual* Chapter Eight.

III (06) Utilities and Railroads

The portions of the project limits which may affect existing utilities should also be addressed early in the PPD phase. The designer should stay in close contact with the district utilities/railroads coordinator to ensure that existing utilities are relocated to avoid delays in the project development. To accomplish this, the district utilities/railroads coordinator should have final check prints as early as possible.

If railroad crossings are within the project limits, the district utilities/railroads coordinator should be advised. See *Indiana Design Manual* Chapters Eleven and Forty-seven.

III (07) Calculations

The calculations must follow a systematic and logical methodology. All calculations should be reviewed for accuracy. Systematic calculations make review and verifying quantities considerably more efficient. All calculations should be submitted with the final documents and should remain the property of the Department.

III (08) Returned Correspondence

Once input from the district maintenance/operations, construction, and traffic sections has been received with suggested changes following the preliminary field check, it may be necessary to arrange and conduct a final field check. See Section III (02) of this memorandum for the personnel list who should attend this field check.

III (09) Final Pavement Design

If the current AADT $\geq 5,000$ or ≥ 500 trucks, a request for a final pavement design should be submitted to the Materials and Tests Division's pavement design engineer. If the AADT $< 5,000$ or < 500 trucks, the designer performs the final pavement design.

III (10) Final Check Prints

The final check prints should now be completed. These documents are outlined below.

1. Transmittal Letter.

- a. Date
- b. To, Thru, From personnel
- c. Contract number
- d. Route number
- e. Counties
- f. Des number
- g. Project description and location
- h. Estimated contract completion date or number of work days
- i. Estimated costs
- j. Letting date

2. Proposal Book Cover Sheet.

- a. Contract number
- b. Letting date

3. Contract Information Book Cover Sheet.

- a. Contract Number
- b. Letting Date
- c. Certifications (approved signatures and stamps)

4. Contract Requirements Worksheet. The designer should place project identification information on this sheet, then transmit it to either the Contracts and Construction Division's Contracts Section or the district construction engineer. The Contracts Section will then transmit it to the district construction engineer. The district construction engineer will determine the other information as required, then return it to the designer. The identification information should be that as follows:

- a. Contract number
- b. Letting date

- c. District
 - d. Project number
 - e. Route number
 - f. Description, including work type
 - g. Location
 - h. Counties
 - i. Effective dates of Supplemental Specifications and List of Approved Materials
5. Table of Contents. The designer should indicate the following documents to be identified on the Table of Contents.
- a. Contract number
 - b. Official Detour Map
 - c. Proposal
 - d. Schedule of Pay Items
 - e. Construction plans and number of pages
 - f. Special provisions
6. Estimate of Quantities and Cost Estimate. All pay items, including undistributed items, should be referenced in the plans. All pay items are to be worded using the nomenclature shown in the INDOT *Standard Specifications* and authorized-estimating-software listing. The sequence, or order of the pay items, should be numerical by INDOT *Standard Specifications* reference number.

III (11) Review of Final Check Prints

After the designer has assembled the final check prints, a copy may be circulated among the other design engineers for review and comment. The final check prints are then forwarded to the district head design engineer for additional review and comments. Upon completion, the designer will make the appropriate revisions.

A copy of the final check prints is to be sent to the appropriate district program development, construction, maintenance/operations, or traffic section as required. They are expected to review and return the copy to the district development section within one to two weeks. A cover letter should be sent with the copy indicating what is expected and when it should be returned.

1. Program Development Review. A copy of the contract documents is supplied for their use in coordinating local agency agreements and detours, and updating the production schedule.

2. Construction Review. The area engineer should review the contract documents and indicate errors, inconsistencies, and constructability. The area engineer fills in the remaining information required on the Contract Requirements Worksheet such as the field office requirements or the need for a profilograph, and also establishes the earliest date to begin work and the contract completion time.
3. Maintenance/Operations Review. The maintenance/operations section reviews the contract documents and suggests additional changes or corrections. The areas of review usually pertain to small drainage structures/pipes, wedge and level, patching, guardrail, and ditch work.
4. Traffic Review. The traffic section reviews the contract documents and suggests additional changes or corrections pertaining to traffic maintenance and traffic safety. They also verify and coordinate the locations and impacts to signal loops, detector housings, no-passing zones, pavement markings, etc.
5. Discussion With Head Design Engineer. After the other sections have reviewed the contract documents and have offered suggested changes, the designer is to meet with the head design engineer to discuss the changes and suggestions. The head design engineer will then decide which corrections are to be made. The designer will then make the appropriate changes.
6. Development Engineer Review. After all changes are made, a copy of the contract documents is sent to the district development engineer for final review. The development engineer may suggest more changes.
7. Materials Engineer Review. The materials engineer may suggest changes to the Plant Laboratory recurring special provision.

III (12) Shelf-Ready Project

The final check prints are considered shelf-ready after they have been reviewed by the development engineer. The documents, now final plans, are to be kept on file until funds are appropriated and a letting date has been established.

III (13) Signatures and Stamps

Once funds are appropriated and a letting date has been established, the final plans should be reviewed and updated. The final plans should then be stamped and/or signed by the appropriate individuals as shown in *Indiana Design Manual* Section 14-1.02(03).

III (14) Contract Documents Package

Upon receipt of the approved final plans by the development engineer, they are ready to be transmitted as contract documents to the Contracts and Construction Division's Contracts Section for processing. The package should consist of the following:

1. Plans.
 - a. 8½" x 11" Plan Sheets Format. The original construction plans and cross-sections with one photocopied set should be transmitted. If the cross-sections are in the 24" x 36" format, the only the originals of the cross sections should be sent.
 - b. 24" x 36" Plan Sheets Format. The original construction plans and cross-sections and two sets of prints of the construction plans without cross-sections prints should be transmitted.
2. Estimate of Quantities and Cost Estimate. The estimate of quantities and cost estimate should be generated using the authorized estimating software. The transmittal shall consist of a floppy diskette and one hard copy of both the estimate of quantities and cost estimate.
3. Special Provisions. One hard copy of the prepared Special Provisions Menu with completed recurring special provisions and unique special provisions should be transmitted. A floppy diskette containing the unique special provisions shall be provided.
4. Detour Maps. The Official Detour Map and Unofficial Local Detour Map, if required, with the approved unofficial local detour documents should be transmitted.

The approved package should be sent to the Contracts and Construction Division's Contracts Section where the documents will be processed and prepared for letting. This step should be completed at least 14 weeks prior to the contract letting date.

III (15) Review Process

1. Pre-Letting. The Contracts and Construction Division may require additional information or further corrections to be made in order for the contract documents to be properly processed. The designer should promptly address these concerns. All responses from the designer should be directed to the district construction engineer.

2. Post-Letting. Following the contract award, a preconstruction conference will be held. The designer should be available upon request to answer any questions.

IV. MODIFYING OR REPLACING EXISTING CULVERTS

When considering whether to modify or replace an existing culvert, the designer should first obtain a copy of the road log from the district office. The road log contains an inventory of the locations, sizes, and types of drainage structures located on each state highway. During the field data collection process, the size, location, and type of each culvert should be verified. Each structure should be thoroughly inspected. See the FHWA's Culvert Inspection Manual for information on structure inspection. See Figure IV-A for a blank Culvert Inspection Report form. If necessary, district operations or maintenance should be contacted to clean plugged or partially plugged structures so an adequate inspection can be performed. The district should be notified of changes that need to be made in the road log.

Once inspection of all culverts to be addressed has been completed, a list of those requiring modification or replacement should be given to the district operations engineer. The district operations section will slip-line or replace pipes of less than 900 mm (36 in.) diameter requiring excavation of less than 1.5 m (5 ft). See Section 31-4.04(02) Item 1 for an explanation of slip lining. This work should be done before the road-work contract is let.

Rehabilitation or replacement should be considered as part of the project work for culverts of 900 mm or greater diameter that have poor roadway geometry or that have a remaining life less than the anticipated life of the proposed road work.

IV (01) Determining Need for Culvert Modification or Replacement

Each culvert to be modified or replaced should be evaluated by an individual familiar with structure inspection.

1. General Considerations. The items to check include, but are not limited to, those as follows:
 - a. Structure alignment with the channel and the potential for erosion or scour.
 - b. Erosion of the approaches, particularly the areas behind the wingwalls.
 - c. Loss of fill material from beneath the roadway.
 - d. Local and contraction scour and general channel degradation.
 - e. Indications of foundation undermining and the potential for foundation undermining.
 - f. Structure settlement.

CULVERT INSPECTION REPORT

_____ DISTRICT

ROUTE _____

R.P. _____

INVENTORY DATA

NO. LANES _____ CLEARANCE _____ FILL _____

DESCRIPTION _____

CULVERT NO. _____ - _____ - _____
(route) (co. no.) (r.p.)ROADWAY ITEMS – RATINGCOMMENTS

ALIGNMENT	_____	_____
PAVEMENT	_____	_____
SHOULDERS	_____	_____
EMBANKMENT	_____	_____
OVERALL	_____	_____

CULVERT ITEMS – RATINGCOMMENTS

HEADWALLS	_____	_____
WINGWALLS	_____	_____
BARREL / BOX	_____	_____
SETTLEMENT	_____	_____
OVERALL	_____	_____

CHANNEL ITEMS – RATINGCOMMENTS

ALIGNMENT	_____	_____
EROSION	_____	_____
SCOUR	_____	_____
DRIFT / SEDMT.	_____	_____
ADEQUACY	_____	_____
OVERALL	_____	_____

OVERALL RATING: _____

MX. NEEDED _____

INSTIP CODE _____

INSTIP Codes: 0 = No Work Needed. 1 = Replace Structure by Contract. 2 = Repair Structure by Contract.

INSPECTOR: _____ DATE _____

BLANK CULVERT INSPECTION REPORT FORM**Figure IV-A**

- g. Timber decay.
 - h. Roadway geometry.
 - i. Hydraulic adequacy.
 - j. Approach erosion.
2. Metal Pipe. Items to check when inspecting a metal pipe include, but are not limited to, those as follows:
- a. Corrosion, including holes which could cause erosion of the surrounding backfill material.
 - b. Excessive deformation.

A metal pipe found to be in poor condition should be considered for slip lining or replacement.

3. Concrete Pipe. Items to check when inspecting a concrete pipe include, but are not limited to, those as follows:
- a. Cracking, efflorescence, delamination, or spalling of concrete.
 - b. Exposed or corroded concrete reinforcement.
 - c. Deterioration at widening joints.
 - d. Settlement or separation of joints allowing backfill material into the pipe.
 - e. Deterioration of structure.

A concrete pipe found to be in poor condition should be considered for resetting, slip lining, or possibly replacement.

IV (02) Culvert Modification

A Structure Data Table should be included in the plans for drainage structures requiring modification. Detail sheets should be provided where required.

1. Slip Lining. Slip lining is a technique for rehabilitating a culvert of 450 mm (18 in.) in diameter or larger. Slip lining is also suitable for use in some box- or arch-type culverts. It is completed by pushing or pulling sections of polyethylene pipe through the existing structure and filling the space between the polyethylene and existing structure with grout. Many times, the capacity of a structure can be increased due to the low friction factor of the polyethylene liner. Factors to consider when deciding whether or not to slip line a structure are as follows:
- a. The structure barrel should be relatively straight and free from obstructions.

- b. The backfill around the structure should be free from large voids.
 - c. There should be sufficient room to work from at least one end of the existing structure.
 - d. The structure should be under at least 2 m (6 ft) of fill or in a location where a road closure is undesirable or impossible.
2. Culvert Extension. A culvert that is structurally and hydraulically adequate, but of insufficient length, may be considered for an extension. Each culvert with a diameter of 1250 mm (48 in.) or greater that will be extended 1.5 m (5 ft) or more will require a geotechnical evaluation. See *Indiana Design Manual* Section 31-3.05(05) for criteria regarding culvert extensions.
3. Culvert End Treatments. See *Indiana Design Manual* Section 31-3.06(02) for desirable design criteria regarding culvert end treatments.
4. Headwalls and Anchors. Removal of headwalls or anchors usually damages the existing structure. As a minimum, 1 m of new structure should be placed for each headwall removed.

Each protruding headwall which is not in accordance with the obstruction-free-zone criteria should be considered for removal or modification. A headwall which is shielded from impact by guardrail should not be removed unless it are located within clearance range of the guardrail as shown in *Indiana Design Manual* Figure 49-4A.

IV (03) Culvert Replacement

Each culvert with a diameter of 1250 mm (48 in.) or greater that is to be replaced will require a geotechnical report and a hydraulic analysis. If a legal drain is involved, the County Surveyor should be contacted for the replacement structure parameters. County soils survey and county drainage maps are available. The USGS 7.5-minute series topography maps provide information regarding drainage patterns at a large scale. The topography maps show rivers, creeks and streams which indicate the drainage pattern of the basin as a whole.

The designer should provide the flow line elevation for the structure to be replaced. The established temporary benchmarks should be shown on the detail sheet. Cross sections should be provided where required for each culvert replacement or new installation.

If a culvert is already in the INSTIP program for replacement, the designer should attempt to incorporate the replacement into the project work.

IV (04) Backfill Materials

See *Indiana Design Manual* Section 17-2.09 for culvert backfill requirements.

V. PAVEMENT DESIGN

V-1.01 Types of Projects

Candidate projects are proposed by the Program Development Division or an LPA and evaluated for pavement treatment. Project scopes may be driven by non-pavement issues such as budget constraints, capacity, safety, drainage, short or long term needs, truck loadings, or geometric deficiencies. The intended project scope and its impacts on the existing or new pavement structure should be understood prior to developing the pavement treatment recommendation. Pavement distresses described in *Indiana Design Manual* Section 52-6.0 should be considered in determining the appropriate treatment for the project. Additional pavement investigation (i.e. core analysis, FWD, condition survey, etc.) of existing pavements may be required to determine the appropriate pavement treatment.

A pavement replacement project includes removal of the existing pavement structure, including any subbase, and preparation of the subgrade prior to placing a new pavement structure. Pavement damage due to structural deficiencies should be reconstructed. A pavement that is structurally sufficient is a candidate for a rehabilitation-type project or for a preventative-maintenance or functional overlay. A pavement requiring 50 percent or more of it to be replaced is generally considered for complete replacement. All work being proposed for a project (i.e. sewer installation, added travel lanes, curve corrections, etc.) should be considered when evaluating the existing pavement.

A rehabilitation project utilizes the existing pavement structure to significantly extend the service life of an existing pavement. A rehabilitation project may include the placement of an overlay with or without a slab reduction process of the existing PCCP.

A partial 3R project is intended to preserve and extend the service life of the mainline pavement and shoulders. A partial 3R project should be designed in accordance with Part I of this memorandum. Partial 3R work generally restores the riding or surface characteristics of the pavement to a near new condition. Partial 3R work includes preventative maintenance, functional, or structural pavement treatments as described in Section V-1.02 of this memorandum.

V-1.01(01) Falling-Weight Deflectometer (FWD) Testing

The designer should evaluate the need for FWD testing pertaining to concrete, asphalt, or composite pavements. The FWD data is used to evaluate the structural adequacy of an existing asphalt section, or to provide an estimated quantity of underseal to be included in the plans for PCCP over dense graded subbase. See Figure V-1A for a sample Instructions for Listing Falling-Weight Deflectometer (FWD) Testing Request form.

V-1.01(02) Pavement Coring

The designer should evaluate the need for pavement coring. If cores are required, the district testing engineer should be contacted for this information well in advance of the date it is required.

V-1.02 Partial 3R Projects

The types of partial 3R projects are as follows:

V-1.02(01) Preventative Maintenance (PM) Treatment

A PM treatment is intended to arrest light deterioration, retard progressive damage and reduce the need for routine maintenance. The proper time for PM is before the pavement experiences severe distress, structural problems, and moisture or aging-related damage. These activities can be cyclical in nature and may correct minor deficiencies for either HMA or PCCP projects.

The HMA PM treatments most commonly used are chip seals, crack sealing, microsurfacing, surface milling and thin HMA inlay, thin HMA overlay, sand seals, asphalt sawing, and sealing joints.

The PCCP PM treatments most commonly used are sawing and sealing joints, retrofit joint load transfer, diamond grinding, and Concrete Pavement Restoration (CPR).

All treatments are described in detail in *Indiana Design Manual* Section 52-11.0.

V-1.02(02) Functional Treatment

An HMA functional treatment consists of an Intermediate course and a Surface course. The placement of the Intermediate course may be preceded by milling. The pavement should be designed in accordance with *Indiana Design Manual* Section 52-9.0.

INSTRUCTIONS FOR LISTING FALLING-WEIGHT
DEFLECTOMETER (FWD) TESTING REQUEST

Please follow the format shown below to request FWD testing.

<u>Date</u>	<u>Route</u>	<u>Project Location</u>	<u>R.P. (Stations)</u>	<u>Pavement Type</u>	<u>Engineer in Charge</u>
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Date: The date you want the FWD testing to be performed.

Project Location: State this information to the nearest 0.1 km from one intersection, etc., to another. Include the county name.

R.P. (Stations): Reference Points in km + m (Pre-existing stations in english units, so that FWD testing technicians or operators can find the correct beginning point.)

Pavement Type: Include history such as asphalt over concrete, chip-and-seal over asphalt, etc.

Engineer in Charge: Name of engineer who will take charge of the FWD testing, with telephone number

EXAMPLE:

<u>Date</u>	<u>Route</u>	<u>Project Location</u>	<u>R.P. (Stations)</u>	<u>Pavement Type</u>	<u>Engineer in Charge</u>
9-08-03	41	2.6 km S. of SR 48 to 1.9 km N. of SR 246, Sulli- van & Vigo Cos.	4+241 to 7+360 (Sta. 139+50 to 241+46)	Asphalt over concrete	D.R. Researcher 765-555-1234

**FALLING-WEIGHT DEFLECTOMETER (FWD)
TESTING REQUEST INSTRUCTIONS**

Figure V-1A

A PCCP functional treatment may consist of Concrete Pavement Restoration (CPR) to be used to correct functional distresses. CPR may consist of crack sealing, partial and full depth patching, resealing of joints, undersealing, diamond grinding, or retrofit dowel bars. An HMA overlay may also be used.

V-1.02(03) Structural Treatment

An HMA structural treatment may consist of Base, Intermediate, and Surface courses, with milling of the existing pavement. The pavement should be designed in accordance with *Indiana Design Manual* Section 52-9.0.

A PCCP with structural failure may be rehabilitated with slab reduction techniques such as cracking and seating or rubblization and overlay. For rubblization, the overlay thickness will depend on traffic counts and the Materials and Tests Division's Geotechnical Section's recommendations. The HMA overlay pavement section for rubblization should be designed in accordance with *Indiana Design Manual* Section 52-9.02(05).

V-2.0 Pavement Cross Section Design

For all selections, several factors should be considered when selecting pavement types. These include, but are not limited to the scope of the project, Life-Cycle Costing analysis, and adjoining pavement types. For rehabilitation and partial 3R projects, the most important factor to consider is the condition of the existing pavement and the scope of the project.

The pavement designer should design pavement sections for the types of projects determined by the scope of work. New or proposed replacement or reconstructed pavements are typically designed for 20 to 30 year pavement design lives. Functional or structural partial 3R projects or rehabilitation projects are typically designed for 10 to 30 year pavement design lives dependent on the base preparation. Preventative Maintenance partial 3R projects are intended to maintain the pavement in a serviceable condition for 4 to 8 years.

V-3.0 PCCP Rehabilitations

PCCP rehabilitations consist of Concrete Pavement Restoration (CPR), a structural treatment, or undersealing. CPR is used where the existing PCCP is structurally sufficient.

1. Concrete Pavement Restoration CPR of PCCP pavements may be used as recommended in *Indiana Design Manual* Section 52-6.03 where the existing PCCP is considered to be structurally sufficient but has reduced serviceability. Typical CPR alternatives are full or

partial depth patching, diamond grinding, joint resealing, retrofit joint load transfer, shoulder restoration, slab stabilization (undersealing), or multiple combinations of these alternatives.

The condition of the driving lane of PCCP is generally a good indicator of the project's suitability for CPR. In addition, falling-weight deflectometer (FWD) testing and core investigation for "D" cracking at joints should be completed. Projects that currently demonstrate full depth patching needs of 1% or less of the total pavement area are candidates for PM. Projects with patching needs from 1 to 5% of the total pavement area are candidates for functional treatments. Projects with patching needs that exceed 5% of the total pavement area are candidates for structural treatments.

2. Structural Treatment. A structural treatment is specified for rehabilitation of pavements with distresses listed in *Indiana Design Manual* Section 52-6.03. The pavement designer will specify the limits of milling, if required, and the overlay thickness. The existing pavement plus the proposed rehabilitation will be designed for structural sufficiency by computing the effective thickness of the existing pavement and comparing this number with the required thickness for the project. The effective thickness for existing PCCP should be determined according to the AASHTO Guide for Design of Pavement Structures, Part III, Chapter 5, Sections 5.6, 5.8, and 5.9 or the Supplement to the Guide. A structural treatment may consist of HMA over concrete or PCCP over concrete.
3. Undersealing. Undersealing consists of a localized activity where a fluid material is pumped under the concrete slab to add support and to fill voids under the pavement. Concrete or composite pavements should be tested with a FWD as described in Section V-1.01(01) of this memorandum to determine size and limits of voids underlying the pavement.

FWD testing must be requested well in advance, 4 to 6 months, of the Ready For Letting date, depending on the time of year. See Figure V-1A for FWD test request procedure and request form.

FWD testing cannot be performed during the winter months. The district should coordinate traffic control activities for the FWD testing.

The cost of the recommended rehabilitation should be compared to the cost of replacing the existing pavement or an alternate rehabilitation technique using life cycle cost analysis.

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Attachments